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THE NORTH AMERICAN DIGGER WASPS OF THE SUBFAMILY SCOLIINÆ.*

OSCAR C. BARTLETT, B. Sc.

INTRODUCTION.

This contribution to our knowledge of the sub-family Scoliinæ (digger wasps) found in North America, Central America and the West Indies, is the result of work done at the Massachusetts Agricultural College under the direct supervision of Doctor H. T. Fernald, and forms a portion of a thesis for the degree of doctor of philosophy. In it, an attempt has been made to place before those interested, a paper in which our present knowledge of these wasps is systematically arranged and the identification of the species facilitated.

There are given here the descriptions of nineteen species and two genera, while four unknown species and one unidentified subspecies are listed at the end. Of the above mentioned species three are new. The type of each genus has been given in the historical sketch and so far as is known, the location of all the types has been stated in each specific description. Whenever the writer thought it necessary, translations from the original descriptions or direct copies have been made. In each case full credit has been given to the original writer.

Several workers have published descriptions of members of this subfamily in various publications and many have from one to several references to the group, showing the scattered character of the information. Works which the writer has found most important are: Saussure and Sichel, *Catalogus Specierum Generis Scolia*, 1864; Burmeister, *Bemerkungen über Bau u. Geschlechtsunterscheide Gattung Scolia*, *Abh. Nat. Gesell. Halle*, 1854; Saussure, *Desc. esp. nouv. Scolia*, *Ann.*

*A portion of a thesis for the degree of Doctor of Philosophy at the Massachusetts Agricultural College.

Ent. Soc. France, (3), 1858; Saussure, *Quelques Scolies de Basse-Californie*, Ann. Ent. Soc. France, (4), 1863; Cresson's descriptions in the Proceedings of the Entomological Society of Philadelphia and in the Transactions of the American Entomological Society; Cameron's descriptions in the *Biologia Centrali-Americana*; the writings of Say, and the Catalogue of the Hymenoptera of the British Museum by F. Smith.

All terms used are fully explained in Smith's Glossary of Entomology. Cresson's system of nomenclature for the wing venation is used.

I am under many obligations to those who have assisted me in making this paper more complete, either by lending specimens to Professor H. T. Fernald that I might use them for study, or by giving me counsel at times when such was needed, especially Dr. Guy C. Crampton, S. A. Rohwer of the National Museum, E. T. Cresson, Jr.; and to Dr. H. Skinner for the privilege of study at the American Entomological Society at Philadelphia. I wish to thank Mr. W. S. Regan who so kindly spent valuable time while studying at New York, Brooklyn, Philadelphia and Washington, in securing for me material to work upon. It was my good fortune to have studied a part of the time under Professor Charles H. Fernald whose aid and assistance I greatly appreciate.

To Doctor H. T. Fernald I wish to express my gratitude for the many ways he has encouraged and guided me in my work and for the aid so willingly given at all times.

COLLECTIONS.

The work in this paper is based upon the collections of the National Museum together with the collections made by members of the Bureau of Entomology in Texas in connection with the Southern Field Crop investigations directed by W. D. Hunter; and the excellent collection at the American Entomological Society at Philadelphia. The American Museum at New York and the Brooklyn Museum at Brooklyn contain valuable material. Besides these, the collections at the Alabama Polytechnic Institute and the Rhode Island Agricultural College are worthy of mention.

NOTE.—Since finishing this paper the writer has seen an article on this group by Mr. N. Banks (*New Scoliidea*, Can. Ent., XLIV, p. 197, 1912). Although arriving too late for consideration in this paper, it does not appear probable that it would involve any changes in it.

HISTORY

The genus *Scolia* was established by Fabricius in 1775. In 1802 Latreille established the family Scoliites, including the genera *Sapyga* and *Scolia*. In 1810 Latreille designated *Scolia quadripunctata* as the type of the genus *Scolia*. In 1817 Leach established a tribe Scolides containing two families, the Tiphida and Scolida. In the latter family he made two divisions to which he gave no names, placing in the first division the genera *Myzine* and *Meria* and in the second division the genus *Scolia*, while he placed *Sapyga* in a separate tribe, the Sapygides. Westwood in 1839 changed Leach's tribe Scolides to the family Scoliidae including under this the subfamily Scoliides and mentioning the genus *Tiphia* but not *Scolia*, apparently because *Scolia* did not occur in Great Britain. For his second subfamily he adopted Leach's tribe Sapygides thus bringing together under the family Scoliidae Leach's tribe III Scolides, and tribe IV Sapygides. He does not appear to have recognized Leach's families Tiphida and Scolida.

Cresson, 1887, included under the family Scoliidae, *Tiphia*, *Paratiphia*, *Myzine* and *Scolia*, placing the Sapygidae as a separate family.

Ashmead, 1903, removed everything from the Scoliidae except *Scolia* and *Elis* and a few genera so closely related to these that they have frequently been regarded as only subgenera. He also made two subfamilies the Scoliinae and Elidinae (now Campsomerinae). Here Ashmead designated the type of *Scolia* as *Scolia flavifrons* Fab. evidently following Bingham who (*Fauna Brit. India: Hymen.*, Vol. I, p 89) had already designated that species as the type of the genus.

May 26, 1911, S. A. Rohwer, in No. 1837 of the Proceedings of the U. S. Nat. Museum Vol. XL, pages 551-587 calls attention to Latreille's paper in 1810 and writes as follows:

"Family Scoliidae, genus *Scolia* Fab. Type *Scolia quadripunctata* Fab. Latreille 1810. Mr. C. Schrottky has contended that the type of the genus *Scolia* Fab. is *Scolia atrata* Fab. *Scolia atrata* was the first species included and according to the system used by Saussure and Sichel, belongs to *Elis*. In stating that the type of *Scolia* is *atrata* Fab., Schrottky adheres to the antiquated first species rule. This adherence is unfortunate as the idea has been entirely done away with by most

systematists in all groups of animals, as well as being ruled against by the International Congress of Zoological Nomenclature."

The genus *Scolia* as originally defined by Fabricius included 10 species. The eighth species, *Scolia quadripunctata* Fab., was chosen as the type by Latreille in 1810. No older designation of type for this genus is known to the writer, therefore *Scolia quadripunctata* Fab. is considered the type of the genus *Scolia*. From this it is evident that the designation of *Scolia flavifrons* as type of the genus cannot hold.

Saussure and Sichel divided genus *Scolia* into the subgenera *Triscolia* and *Discolia*. As already stated *Scolia flavifrons* was selected by Bingham as the type and belonged to the subgenus *Triscolia*. The type *Scolia quadripunctata* selected by Latreille belongs to the subgenus *Discolia* however and upon raising these subgenera to generic rank, *Discolia* becomes a synonym of *Scolia* while *Triscolia*, regarded by Ashmead as a synonym of *Scolia* because *flavifrons* which he selected for the type belonged in that section, necessarily is restored from a synonym to a valid genus. *Triscolia* was established by Saussure and Sichel and under it were placed twenty-five species, none of which was designated as the type. So far as the writer has observed the only species of this list which has been designated as the type since, is *Scolia flavifrons* Fab. which was done by Bingham as already indicated. Accordingly therefore the subfamily Scoliinae may be considered so far as North America forms are concerned, as including the genus *Scolia* with *Scolia quadripunctata* Fab. as its type, and the genus *Triscolia*. As the latter had the species *flavifrons* designated as its type when it was supposed that it was a synonym of *Scolia*, it would seem desirable to retain this same species as the type now that it has become an established genus. *Scolia flavifrons* Fab. is therefore here designated as the type of the genus *Triscolia*, no earlier designation for this genus having been observed.

The above is the history of this group that the writer wishes to adhere to, yet Schrottky in the *Deutsch Ent. Zeitschr* 1910, Heft II, page 196 says that *Triscolia* of Saussure and Sichel should become *Ascoli* of Guerin. In tracing *Ascoli* back to the reference, (Guerin, Duperry: *Voy. Coquille. Zool.* II, 1830, page 247,) I find it indeed true that this is the first reference to the insects included in the group *Triscolia*, that is so far as can

be ascertained by a study of the work concerned, for the factors which were used to separate the sections of Guerin's groups when compared with the important writers on *Scolia* become hard to discern. The following is a translation of Guerin's classification leading to Ascoli:

- I. Superior wings with four cubital cells.
(The writer's three *closed* cubital cells.)
- II. All the cubital cells reach to the radial cell.
 - A. Two recurrent nervures. (Cosila).
 - B. One recurrent nervure. S. G. Ascoli.

As an explaining phrase Guerin writes beneath division B "Nous n'en connaissons pas encore." Of course he does not give any examples as he has under his other divisions in his tables. Under these conditions the writer is not yet prepared to use the term Ascoli. If it should ever be adopted the writer sees no reason why *Scolia flavifrons* Fab. could not still remain the type under this older name.

HABITS.

Having never been able to study this group of insects in the field the writer has been obliged to depend on other writings on *Scolia* for information as to their habits. Westwood says that the genus *Scolia* comprises many species, inhabiting the hottest regions of the globe. Dufour states that *Scolia hortorum* abounds in the very hottest situations and that it is very fond of revelling in strong scented flowers. A correspondent of the Entomological Magazine (Vol. III, p. 436) states that *Scolia bicincta* Fab. makes its burrows in sand banks, to the depth of eighteen inches, with a very wide mouth; in digging into one a female had entered he found a large locust, *L. lineola*, which is probably its prey. The males of this genus are usually taken singly on flowers, but the males of *Scolia interrupta* and *four-punctata*, which are extremely sluggish, are found crowding on the ears of grass near the seaside, where they pass the night. Latreille thought that *Scolia punctata* was parasitic upon some of the bees which build in old wood, and Shuckard states he caught *S. punctata* entering into the cells of *Osmia bicornis*. Robineau Desvoidy has proved this fact, having found cocoons of *S. punctata* in the cells of *Osmia hellicicola*, in which situation he observed the metamorphosis of this species without however, having detected the female in her operations. Riley in the sixth report of the Missouri

State Entomologist says that *Scolia flavifrons* attaches its egg to the venter of the larva of a common European lamellicorn beetle larva. Ashmead, Can. Ent. 35, states: "So far as is known the species are parasitic upon the larvæ of ground beetles belonging to the family Scarabæidæ and probably also upon other ground inhabiting beetle larvæ."

The following is a translation from Burmeister (Naturf. Ges. Halle): To see strange insects emerge from ant heaps is always surprising to the entomologist; he has every reason to assume that, if this is repeated often, then a normal condition exists. This is true of *Scolia campestris* of Brazil. I am therefore inclined to the opinion the *Scolia campestris* lives in the inside of the ant hills as larvæ and probably feeds as a parasite on the larvæ of the *Atta cephalotes*.

Such observations as the above would seem to imply that the insects belonging to the family Scoliidæ are parasitic on larvæ of a great many insects and that they are solitary, never living together in numbers in the same nest. The males are very apt to frequent highly scented flowers and a great many that the writer has examined show this, because the body, usually quite hairy, is well covered with pollen grains in many cases. So little data has been submitted on the habits and life of this group that an investigation of them should prove worth while and very interesting.

EXTERNAL ANATOMY.

HEAD. Viewed from in front the hypognathous head is subcircular but apparently elongated beneath by the projecting mandibles. At the sides are the somewhat kidney shaped eyes, made so by a deep emargination just above the middle of the inner borders which leaves the lower lobe much larger. In the male the emargination is well up toward the top of the head causing the lower lobe to be comparatively much larger than in the female.

Clypeus. The clypeus extends downward from the bases of the antennæ, its edge between these points being emarginated. Laterally it extends nearly to the eyes, the suture curving downward somewhat, and is separated from the eye by a narrow extension downward of the frons. Its lower margin varies from a broad gentle curve to nearly a straight line in some cases and this margin is liable to be reflexed. In the male the clypeus

is more triangular in outline, with the base of the triangle below. Except for a small area in the center it is punctured everywhere, the punctures gradually becoming deeper and closer from the central space outward. It is more or less covered with short stiff hairs but the whole surface has a shining appearance.

Frons. The frons extends upward from the base of the clypeus to the ocelli where it joins the vertex though no suture is present.

There is a downward projection on each side of the clypeus to the base of the mandible, narrow in the male and wide in the female. A transverse suture extends just behind the ocelli and then in some cases a little forward and outward toward the eyes. The antennæ are inserted in the frons close to its lower border, beneath two strongly developed oblique ridges, these insertions being slightly farther apart than the distance of either from the compound eye. The frons is more or less deeply punctured and hairy, particularly so between and around the base of the antennæ. The hair may become worn away to very short stubs, apparently a result of the digging habits of the insect.

Ocelli. The anterior ocellus is the larger. Behind the ocelli the head gradually rises to its highest point. It is rather sparsely punctured near the ocelli but behind its highest point its punctures become quite close again. This portion of the head may be termed the vertex but no sutures are present separating it either from the cheeks at the sides, the frons in front of the ocelli, or the occiput behind. The hinder part of the head behind the vertex and cheeks bears a narrow semi-circular ridge within which is the articulation with the thorax. The back of the head close to the ridge is thickly clothed with rather long, stiff hairs.

Cheek. The portion of the head behind the compound eye is called the cheek. Viewed from the side it is widest behind the top of the eye. For a short distance downward it is of about the same width and then narrows very rapidly to the base of the mandibles. It is punctured and hairy more or less everywhere.

Labrum. A short distance above the lower edge on the inside of the clypeus the labrum is attached. In preserved specimens it is bent backward at right angles to the clypeus,

covering the cavity which holds the folded sucking mouth parts. With the large mandibles closed over it the labrum is not accessible for study except by dissection. There has therefore been no attempt made to use its characters for classification.

Mandibles. Each mandible is a fairly long and strong hook decidedly suggesting rapacious habits. The front surface has a deep longitudinal furrow at its inner border while the hind surface is set with stiff outstanding bristles, extending from a deep furrow at its outer border. Between these two and on the front surface is a third shallow furrow which runs the whole length of the mandible. A study of many individuals shows a variation in the structure and relative proportions of the mandibles, they probably being worn and modified by the digging habits of this group. In the female the middle of the inner margin sometimes shows tiny blunt projections (hardly long enough to be called teeth) varying in size with the different species and in the same individual. The male mandible is more delicate than the female. Its inner middle margin shows three well defined teeth besides the sharp end tooth. The surface of the mandibles is smooth and shining.

The maxillary palpus is composed of six segments and the labial palpus has three segments.

The other mouth parts cannot be studied except after dissection and therefore are not readily available for analytical work. For this reason they are not considered here.

Antennæ. In the male these are long, almost cylindrical and almost straight. The basal portion of the first segment or scape is a small spherical bulb which has every appearance of being a separate segment. This is not the general opinion however so it is here considered a part of the scape. The distal portion of the segment is long and very near a perfect cylinder. It narrows quickly at either end to articulate with the bulb and the pedicle. The pedicle is small and cup-shaped, its smaller end toward the body. These segments are smooth and shining. The filament consists of eleven cylindrical segments, very little thickened in the middle and only separated from each other by a fine seam. As a whole it is stout gradually increasing in diameter to near its end, then gradually reducing. The segments of the filament are considerably longer than their diameter and are dull, not reflecting the light.

In the female the antennæ are more condensed, being thicker and shorter. The scape is large, stout, elongate-ovate, with its greatest diameter near its outer end. The second segment is similar to that of the male but articulates somewhat obliquely with the scape which tends to turn the outer part of the antenna backward. The ten segments of the filament with the exception of the last are no longer than their diameter and articulate with each other quite obliquely. Their surface in general is dull though the first segment or two may be somewhat glistening. The outline of the filament as a whole resembles that of the male.

THORAX. The pronotum aside from the portion forming the upper side of the neck extends to the tegulæ, below which it projects a little farther backward. From this point its edge then runs forward and downward, forming a curve to the base of the fore coxæ. Between the tegulæ its margin is deeply excavated to accomodate the front of the mesonotum. The front margin of the prosternum on the neck is considerably posterior to that of the pronotum making the articulation with the head quite oblique. A Y-shaped groove a short distance behind its anterior margin separates what may be considered the neck portion of this plate from a swollen lateral lobe on each side, at the hind end of which the fore coxa articulates.

The surface of the pronotum is more or less coarsely punctured and provided with hairs except along a strip where its neck and vertical portions meet. The sternum is everywhere similarly punctured but the hairs along the Y-shaped groove are much smaller and decumbent.

The mesonotum is a broad convex plate, very near a regular hexagon in outline, lying between the wings and extends forward to the prothorax, and to the tegulæ at the sides. From the middle of the anterior edge a groove extends backward varying in length and distinctness. From a point just inside of the place where the edge of the scutellum joins the mesonotum a pair of grooves pass forward from its posterior margin parallel to each other. These grooves varying in length, depth and width are probably the parapsidal grooves. The mesonotum is coarsely but somewhat sparsely punctured except near its center which is smooth. Just behind the mesonotum lies the scutellum. It is more or less deeply punctured and hairy, and is a transverse plate with its central portion

raised about as high as the mesonotum. Its sides are abruptly bent downward along a line beginning at the parasidal grooves and extending backward and toward the center of the body giving this portion the form of a trapezoid whose basal angles are equal, with its longest base toward the anterior end of the body. The lateral, sharply depressed portion of the scutellum narrows quickly as it passes outward and downward and the hind wing arises from just behind its outer end while the fore wing arises somewhat lateral to its outer end which extends forward somewhat below the hinder corners of the notum.

The mesothoracic pluron is large and lies below the wings. The whole surface of this plate is gradually raised to a rounded ridge which runs downward and backward through its middle and is more or less hairy and coarsely punctured. The anterior margin of this plate is indicated by a curved suture running downward and slightly forward to the base of the fore coxa while its posterior margin is indicated by a suture starting just in front of the margin of the posterior wing and running downward and backward to the highest point of the mesocoxa in front of which it forms the anterior edge of the coxal cavity. This plate fuses beneath with the mesosternum, no suture being present to separate the plates. The anterior margin of the mesosternum is formed by the contiguous fore coxæ and its posterior margin is in part formed by the inner sides of the mesocoxal cavities and in part by a free edge between them, the two mesocoxal cavities being suddenly separated. The intercoxal margin of the mesosternum varies from a nearly straight to a more or less curved line with a notch in the middle. A longitudinal median line varying in distinctness divides the mesosternum into two equal parts. The mesosternum is more or less coarsely punctured and haired.

The postscutellum which lies just behind the scutellum is a similar plate but a little narrower. Its central portion is raised to about the same height as the central portion of the scutellum and becomes narrow behind and then broadens somewhat, close to its hinder margin. Its sides beginning on a line with the sides of the scutellum are abruptly bent downward to correspond with the similar portions of the latter plate and its margins running downward and forward nearly parallel, end at the base of the posterior wing. The plate is more or less coarsely punctured and haired.

The metapleuron extends downward and backward from the base of the posterior wings. Half-way between the base of the wings and the base of the metacoxa the plate narrows and appears to be separated into two parts by a transverse furrow. The upper part is very near the shape of a triangle, with one side, the hinder one, rounded. The lower part continues downward and backward between the edges of the median segment behind and the mesopleuron in front forming the posterior part of the mesocoxal cavity, the upper and anterior parts of the metacoxal cavity and passing between the two coxal cavities to unite with the metasternum though there is no trace of the suture between these two plates. Both parts of the metapleuron are more or less coarsely punctured and hairy. The metasternum extends backward from the mesosternum between the meso and metacoxæ, its sides in part forming the ventral edges of the coxal cavities and the apparent posterior margin is free. This part of the metasternum is only sparsely punctured and covered with hairs while its shape varies. It has a median groove extending forward from the apparent hinder margin for a varying distance. This apparent hinder margin is not the real one, however, the plate turning backward on itself for a short distance, then bending at right angles and passing dorsalward, thus forming a backward projecting flange. The vertical portion is bilobed and at its dorsal margin (the real posterior margin of the plate) articulates with the sternal plate of the petiolar segment. This flange is covered with coarse punctures and long coarse hair.

MEDIAN SEGMENT. The median segment is really the first segment of the abdomen which has become closely connected with the thorax and has often been considered one of the segments of this division. It is followed by the petiole, a constricted portion which extends backward and suddenly enlarges to the regular size of the abdominal segments. For any morphological consideration this arrangement should be remembered but for convenience in this paper the petiole with its enlarged portion is considered the first segment of the abdomen.

Viewed from above the median segment appears to be composed of a central portion and a lateral portion on each side, the separation of these parts being indicated by a depressed line or shallow groove arising at the front margin of the plate nearly opposite the point where the central elevated part of the

postscutellum joins the side portion and becomes depressed. These two lines converge as they pass backward and continue to the sides of the base of the petiole. The central portion of the median segment extends backward a distance about equal to the length of the scutellum then sharply bends downward to the petiole, its two surfaces forming nearly a right angle. Both of these surfaces bear coarse punctures and hairs. A short distance behind the upper posterior corner of the metapleuron a long narrow, nearly vertical, spiracle occurs near the anterior margin of the latter portion of the median segment. The groove separating the metæpisternum from the metæpinuron appears to continue upward and backward into the side of the median segment, passing below the spiracle and extending a short distance behind it. From a point near the lower end of the spiracle this lateral portion appears to become sharply compressed into a dorsal, nearly horizontal and a lateral surface, the latter being so bent inward that the sides of the insect in this region actually overhang. These lateral portions extend somewhat farther back than does the central portion so that the posterior end of the median segment as a whole has its lateral corners projecting farther backward. At its lower hinder edge the median segment articulates above with the dorsum of the petiolar segment. The surface of the lateral portions is more or less coarsely punctured and haired.

ABDOMEN. The abdomen has six visible segments in the female and seven in the male which excepting the first and the sixth, seem to have no structures of importance. The part of the abdomen behind the petiolar segment viewed either from above or below enlarges for a short distance then gradually narrows in a regular curve, to where a pair of spines project from the surface of the last segment. The sternum of the second segment shows a distinct anterior face where it bends abruptly downward from its articulation with the posterior lower margin of the petiolar sternum, thus giving the middle portion of the abdomen its greatest vertical diameter. Behind the second segment the distance apart of the dorsal and ventral plates gradually decreases. The surface of each segment is more or less coarsely punctured and hairy and close to the posterior margin of each the punctures are more numerous. From these punctures project stiff hairs overlapping the anterior edge of the next segment beyond, to form a fringe. All the hairs are quite decumbent particularly those above.

In proportion to the rest of the insect the abdomen as a whole is heavy causing it to sag downward and gives the insect a clumsy appearance especially the female.

First segment of the abdomen. The narrow part of the first segment of the abdomen known as the petiole, viewed from above is about one-third as wide as the median segment or of the widest portion of this segment itself while the vertical diameter of this part is about two-thirds its width. It continues backward from the base of the median segment for a very short distance then rises sharply and gradually broadening, to a point about the level of the top of the median segment. It then bends backward to form the dorsal surface of the hinder non-petiolar portion of this segment. The ventral part of this segment is divided into two portions. The first is a small, convex, somewhat oblong area with rounded corners and a posterior median shallow notch, the whole much resembling in form the labrum of some Acrididæ. Its surface is finely and closely punctured and is well covered with long hair.

The posterior portion of this sclerite is markedly triangular, all its margins being concaved. The posterior angles are quite sharp but the anterior one where it joins the front section first described is about the width of the petiole. The posterior margin has a rather dense fringe of short backward directed hairs. The surface of this portion of the sclerite is rather sparsely covered with punctures and hairs.

A somewhat triangular projection forward and outward from the anterior corner of the second dorsal abdominal plate seems to wedge itself between the hinder corners of the notum and sternum of the first segment and a line arising near the base of the projection on the notum of the first segment and running obliquely downward and forward to meet the lateral margin of this plate at the hinder edge of the first section of the sternum already described may perhaps represent the former line of separation between the notum and pleuron in this segment: if so the pleuron is now the lateral margin and an actual part of the notum.

Last segment of the male. The terminal segment of the male requires a separate description. In this sex the lateral margins of the dorsal sclerite overlap the corresponding margins of the sternal sclerite from the base of the segment backward to the point where a lateral spine protrudes from between the two

plates of the segment. From this point backward there is no lateral portion to the plate it being entirely dorsal and with its margin rather oval in outline varying somewhat perhaps in some species.

The base of the ventral segment at its sides is concealed by the lateral margins of the dorsal plate. Its lateral margins are nearly parallel almost to the end of the segment, the hinder margin being very broadly and bluntly acuminate. Along the median line of the plate extends a distinct ridge.

Between these two plates projects the end of a third, only the outer portion of which is strongly chitinized. Its sides are approximately parallel and at the hinder end it bears three spines one in the center and one at each corner. The median spine is larger and stouter than the lateral ones and extends backward some little distance into the body of the plate forming a distinct central ridge on the under surface. The body of the plate as a whole is somewhat convex from side to side beneath. The homology of this three spined plate has not been worked out by the writer but as the reproductive organs are just above it, it would seem not impossible that it is the ventral plate of another segment partly drawn within the one described as terminal and of which the dorsal portion has either been lost or at least has not been observed in the course of this work.

Last segment of the female. The lateral margins of the last dorsal sclerite in the female are considerably prolonged ventrally over the corresponding margin of the sternum of this segment thus concealing the latter. The edge of this portion extends backward and upward to the base of the spine near the margin on the ventral plate (to be described later) above which it turns backward and gradually inward to form the hinder margin. The outline of this portion varies greatly in different species. On the side of the dorsal plate near its base and close to the edge of its dorsal surface a ridge arises extending backward and finally ending above the more or less spine-like structure of the ventral plate. This ridge varies in form in different species.

The last ventral plate in the female is quite convex from side to side and its lateral margins turn inward almost horizontally, the two edges nearly meeting at the nearest point. This inflexed portion of each side is concealed by the dorsal plate only the hinder margin which varies in outline in different

species, being visible. At the side of the visible portion of the plate close to the margin of the dorsal sclerite is a projection more or less of the form of a spine but sometimes shorter and with a blunt end. It projects outward and backward from the general surface of the body at this point and its antero-posterior location on the plate varies somewhat in different species.

WINGS. The wings of this group as far as observed are generally fuliginous with a bluish, purplish, or even somewhat greenish reflection. In a few cases the wings are nearly hyaline but then are liable to have a yellow tinge and more or less well developed fuliginous areas particularly toward the apex, and at these places the reflection appears.

In this paper wing areas entirely enclosed by veins are termed closed cells while those not entirely enclosed by veins and extending to the margin are regarded as incomplete or open cells. At the base of the wing are three rather long closed narrow cells. These passing backward from the costal margin are respectively, the costal, median and submedian cells. Between the latter and the hinder margins is an open anal cell. Between the outer end of the costal cell and apex of the wing are two closed cells, the one next to the costal occupying the place where the stigma is usually found and which may therefore be called the stigmal-cell. It is quite narrow. External to this is the much larger radial cell and extending from the latter to the apex, is a large open cell. Behind the stigmal cell lies the first cubital, lying behind the outer end of the costal cell and at the outer anterior corner of the median cell while its outer end is behind the inner portion of the radial cell. Behind the greater part of the first cubital and the radial cells lies the second cubital and in some cases, is a small closed cell, the third cubital between the outer end of the second cubital and the apex of the wing. The area sometimes occupied by the third cubital cell is sometimes thrown into the open cell already referred to which extends to the apex of the wing, there being no third cubital present in such cases. Behind the outer part of the median, the base of the first cubital and the base of the second cubital cells, lies the first discoidal and at the outer end of the submedian and behind the basal half of the first discoidal lies the second discoidal cell. External to the second discoidal cell and behind the outer parts of the first discoidal and second cubital cells lies the third discoidal cell, combined

with the second apical cell which is open at its outer end, no cross vein separating these two being present in the American members of this subfamily. Behind this cell is a space extending to the hinder margin, the first apical cell.

There is a variation in the number of cubital and discoidal cells and upon this variation depends the separation of the group into genera. There also seems to be a variation in the shape of the radial and cubital cells which may be of some specific value. The radial cell differs in the different sexes and there seems to be an area more or less confined to the costal, median, stigmal, first cubital and radial cells which is usually covered with hairs. The region beyond the closed cells is very finely striate with parallel lines. This fact alone would serve to separate this subfamily from two of its nearest allies, the Myzinidæ and Tiphidæ if other structures were not available.

The veins which appear in the front wing of this group are the costal, subcostal, externo-medial, anal, basal, first, second and third transverse cubital, transverse medial, discoidal, cubital, first recurrent and subdiscoidal veins. Their arrangement and relation to each other are shown by figure. Either the presence or absence of a third transverse cubital nervure causing either the presence or absence of a third closed cubital cell is a generic character as before stated.

The fact that there is but one recurrent nervure is of subfamily value separating the Scoliinæ from the Campsomerinæ, the other subfamily of this family Scoliidæ.

Along the central portion of the hinder margin of the anterior wings just internal to a nearly central notch of this margin on the anal cell is a fold known as the frenal fold, in which the frenal hooks of the hind wing catch so that the two wings may act together.

There seems to be nothing of systematic importance in the structure of the hind wing. About one-third of the distance from the base of the wing on the posterior border there is a deep narrow sinus and at about the center of the anterior border are the frenal hooks spoken of above. Except for a very few hairs mostly near the costal border the hind wing is naked.

TEGULA. The tegula is a small three sided, very convex, plate lying over the base of the fore wing, separating it from the dorsal plate of the prothorax in front and from the mesonotum above. The surface of the tegula is usually smooth and shining.

except near its base where it shows a few punctures and hairs. Beneath the base of each wing there is only one principal long narrow plate, called the subalar by Crampton in a treatise on the thorax of insects in 1909. Above the base of each, just behind the tegulae are located two plates which probably represent detached portions of the basal parts of the veins of the wings.

LEGS. The legs of this subfamily are not long but are stoutly built, the general structure being reenforced by spines and hairs of unusual length and thickness especially in the female. The front legs of the female are especially developed probably to aid in digging in the earth.

The coxa, trochanter and femur of the front leg have no spines in either sex. The femur of the middle leg in the female however bears on the outer side of its outer end, one or sometimes two small spines and at the same place on the hind femur a transverse row of similar spines. In the male the mid femur has, in rare cases, such a spine at the above location and the posterior femur always bears a row of short spines at the same place. The other segments of the legs are more or less covered with rows or else isolated stout spines especially in the female. The front legs in both sexes are always the shortest and the parts beyond the femur in the female are somewhat flattened. The size and length of the legs increases from in front backward and the length of the first tarsal segment in the three pairs of tarsi from front to rear is very nearly in a ratio of one, two and four in both sexes.

In the front leg the tibia is much shorter than the femur; in the middle leg it is but little shorter; while in the hind leg the two segments are about equal in length.

The mid coxae are always far apart, (a character used to separate the Scoliidae from the other closely allied families) and are small globular or subconical in form. The fore and hind coxae are quite large, of about the same size and conical. The former are contiguous but the latter are widely separated.

At the top of the last tarsal segment is a pair of simple claws, (a character used to separate Scoliidae from the Myzinidae). Between these claws is a good sized pulvillus.

At the end of the tibia there are always several spines and at the end of the middle tibia is always a spine much larger and longer than the others, while at the end of the hind tibia there

are always two such spines of about equal length and much larger and longer than the others.

All the segments of the legs are more or less covered with coarse punctures and long hairs.

The three pairs of trochanters are well developed and are longer at the outer end where they articulate with the femur which also enlarges outward to where it articulates with the tibia. The fore tibia has at its end just beneath its anterior edge a large, curved, much modified spine which in connection with a corresponding modification at the base of the first tarsal segment, acts as a cleaning apparatus. Beginning at the base of this enlarged spine on the tibia and extending backward along the anterior margin is an area of short, fine hairs set close together to form a pad-like structure. This is not so strongly developed in the male but there is a sericeous appearance in its place. Beneath the hind margin near the outer end three stout spines usually project and a row of short stout spines projects from beneath the edge of the end.

There are five tarsal segments. The first and fifth are much longer than the others and in the female the tarsal segments of the fore leg are somewhat flattened. Their posterior edges bear a row of long stout spines and their ends and anterior edges have a row of similar spines except the part of this edge of the first segment which is opposed to the large modified spine of the tibiæ. Here the edge is sharply concave and has short, blunt, tooth-like projections. On the ventral surface of the same segment, behind this concave edge and near its base, a row of long stiff hairs projects downward.

The dorsal surfaces of the mid and hind tibiæ are set with longitudinal rows of stout spines. The mid and hind tarsal segments except the last, are cylindrical and bear irregularly set spines. Their ends are encircled by a row of stout spines.

The relative size of the segments of the legs increases from front to rear and there are no spines on their ventral surfaces.

SEX DIFFERENCES. Most of the differences of sex have been mentioned above. Some of the more conspicuous are restated as follows: In comparison with the female, the male is much more slender and always smaller. The outline of the clypeus is much different; the antennæ of the female have twelve segments which are short, blunt and recurved while those of the male have thirteen segments and are long, slender and usually

straight. The female abdomen has at its end a sting while the male has three sharp spines. The segments of the fore tarsi in the female are flattened somewhat while those of the male are cylindrical. Legs of the male have fewer spines and hairs than those of the female which present a very bushy appearance. The abdomen of the female has six segments and that of the male seven.

GEOGRAPHICAL DISTRIBUTION.

The insects of this group occur in all the continents of the world but are most abundant in tropical regions. There the specimens are usually very large and although in the greater number of cases the ground color is very dark or black, there are spots, bands, etc., of the brighter colors.

Specimens of this group become more and more rare as the climate becomes colder. Apparently the Upper Austral zone marks their northern limit with perhaps the exception of occasional stragglers into the Transition zone.

Within the territory this paper attempts to cover, namely North America, the species of the subfamily Campsomerinae seem to far outnumber those of the Scoliinae.

Subfamily SCOLIINÆ Ashmead.

- SCOLIA: Fab., Syst. Entom. 1775, p. 355, n. 111.
 SCOLIETÆ: Latr., Hist. Nat. Ins., 1805, Vol. XIII, p. 270.
 SCOLIDA: Leach, Edinb. Encyl., 1812.
 SCOLIDES: Leach, Encyl. Brit., 1817.
 SCOLIDA: Leach, Edinb. Encyl., 1817.
 SCOLIITES: Newm., Ent. Mag. II, 1834.
 SCOLIIDÆ: Westw., Intr. Class. Ins., 1840, Vol. I, p. 82.
 SCOLIIDES: Westw., Intr. Class. Ins., 1840, Vol. I, p. 82.
 SCOLIA: Burm., Abh. Naturf. Ges. Halle, 1853.
 SCOLIA: Sauss. and Sichel, Cat. Spec. Gen. Scolia, 1864, p. 14, genera Scolia and Elis.
 SCOLIA: Cresson, Syn. of Hymen. of Amer. north of Mex., 1887, p. 108.
 SCOLIA: Bingham, Fauna Brit. India; Hym., Vol. I; 1897.
 SCOLIIDÆ: Ashmead, Can. Ent., Vol. XXXV, 1903, p. 7.
 SCOLIINÆ: Ashmead, Can. Ent., Vol. XXXV, 1903, p. 7, (subfamilies Scoliinae and Elidinae).
 LIACOSINÆ: Schrottky, Deutsch. Ent. Zeitschr., 1910, Heft. II, p. 196.
 SCOLIIDÆ: Rohwer, Proc. U. S. Nat. Mus. Vol. XL, p. 552, 1911.

SYNOPTIC TABLES FROM VESPOIDEA TO SUBFAMILY SCOLIINÆ

The writer has used portions of Ashmead's tables published in the Proceedings of the U. S. National Museum, Vol. XXIII, and in The Canadian Entomologist, Vol. XXXV.

Abdomen sessile or petiolate, with the first ventral segment distinctly separated from the second by a more or less deep constriction or transverse furrow; legs most frequently fossorial.....1.

1. Middle coxæ contiguous or nearly so.
Cosilidæ, Rhopalosomidæ, Thynnidæ, Myrmosidæ, Mutillidæ.
Middle coxæ distant, usually wide apart.....2.
2. Stigma of front wing not well developed, at most only slightly developed, either very small or linear; eyes most frequently emarginate within; middle tibiæ with two apical spurs.....3.
- Stigma of front wing well developed, ovate or subovate; eyes entire, never emarginate within; pygidium in male entire, the hypopygium terminating in a sharp aculeus, which curves upward.....*Tiphidæ.*
3. Pygidium in male entire or at most with only a slight sinus; the hypopygium ending in three spines; claws simple.....*Scoliidæ* 4.
- Pygidium in male deeply emarginate at apex, the hypopygium terminating in a sharp thorn or aculeus, which curves upward and rests in the emargination of the pygidium; claws cleft.....*Myzinidæ.*
4. Front wings with only one recurrent nervure; if with two the second recurrent is incompletely formed, and bends backward so as to unite with the first; the second cubital cell receiving only one recurrent nervureSubfamily *Scoliinæ.*
Front wings with two complete recurrent nervures, both of which are received by the second cubital cell.....Subfamily *Elidinæ.*

TABLE OF SPECIES.—SCOLIINÆ.

1. Fore wing with three closed cubital cells *Triscolia*. 2.
Fore wing with two closed cubital cells..... *Scolia*. 3.
2. Black; abdominal segments beyond the second, reddish brown; wings with slight greenish reflection..... *T. fervida* Burm. (315)
Entirely reddish brown; wings with a strong green metallic reflection...
T. badia Sauss. (314)
3. Body entirely without color markings.....4.
Body not entirely without color markings.....6.
4. Second abdominal segment more or less tubercular beneath.....5.
Second abdominal segment not more or less tubercular beneath.....
S. monticola Cam. (330)
5. Body entirely black, hairy and densely punctured. Wings dark fuliginous.
A darker area along the costal border..... *S. guttata azteca* Sauss. (326)
Body entirely dark brown, smooth and shining; wings light fuliginous throughout..... *S. cubensis* n. sp. (318)
6. Body with yellow markings.....7.
Body without yellow markings, head and thorax black, segments of the abdomen beyond the second, ferruginous.. *S. dubia hæmatodes* Burm. (320)
7. Second abdominal segment more or less tuberculate beneath.....8.
Second abdominal segment not more or less tuberculate beneath.....9.
8. Wings with metallic color reflections, blue and purple, larger hind tibial spur less than one-half the length of the first tarsal joint....
S. guttata guttata n. subsp. (325)
Wings without metallic reflections, shiny brown, length of the longest hind tibial spur about one-half the length of the first tarsal joint....
S. fuscipennis n. sp. (324)

9. Venter of the abdomen all black. 10.
 Venter of the abdomen ferruginous or partly so. 11.
10. Head all black, body covered with black hair. Free edge of the clypeus a regular curve. *S. bicincta* Fabr. (316)
 Head with yellow marks behind the eyes, body covered with grey hair. Free edge of the clypeus very near a straight line with the lateral edges meeting this edge close to the perpendicular. *S. vintschgaui* D. T. (336)
11. Thorax all black, dorsum of third abdominal segment has two oval yellow spots. *S. dubia dubia* Say. (319)
 Thorax not all black. 12.
12. Venter of abdomen all ferruginous, body covered with greyish white hairs, antenna slightly ferruginous. *S. fulviventris* n. sp. (323)
 Venter of abdomen not all ferruginous, maybe black or yellow ferruginous. 13.
13. Thorax covered with yellowish grey hair; antenna black. *S. consors* Sauss. (317)
 Thorax not covered with yellowish grey hair. (Yellow or darker). 14.
14. Wings fuliginous throughout. *S. nobilitata* Fabr. (332)
 Wings not fuliginous throughout. 15.
15. Ventral abdominal segments beyond the second, dark ferruginous slightly mottled with yellow; dorsal segments 3, 4, 5, 6, yellow except the anterior edges slightly ferruginous. *S. otomita* Sauss. (333)
 Ventral abdominal segments beyond the second, not dark ferruginous and not mottled with yellow. 16.
16. Head all black except yellow marks behind the eyes and along the inside edges of the lower lobes of the eyes. 17.
 Head, except yellow marks behind the eyes and along the inside edges of the lower lobes, not all black. 18.
17. The dorsum of the abdomen has no yellow on it, except on the third segment which has two oval yellow spots. *S. inconstans* Cress. (327)
 The dorsum of the abdomen beyond the first segment, more or less marked with yellow. *S. flavocostalis* Cress. (321)
18. Top of head behind the lower ocellus and body color of the thorax black. *S. lecontei* Cress. (329)
 Top of head behind the lower ocellus and body color of the thorax ferruginous. *S. ridingsii* Cress. (334)

DESCRIPTIONS.

The lists of references to these insects given by Saussure and Sichel and especially by Dalla Torre are so full that it has not seemed necessary to copy them here. It has therefore been my intention only to make the American references complete by publishing any that were not in Dalla Torre's Catalogue:

Genus *Triscolia*. Saussure and Sichel.

Genus *Triscolia*. SAUSSURE and SICHEL, Cat. Spec. Gen. Scolia, 1864, p. 14.

Generic characters: Three closed cubital cells.

Type: *Scolia flavifrons* Fab.

BIBLIOGRAPHY.

- Ascoli* GUERIN, Duperry, Voy. Coquille, Zool. II, 2, 1830, p. 247.
Triscolia SAUSS. and SICHEL, Cat. Spec. Gen. Scolia, 1864, p. 14. (subgenus).
Scolia BINGHAM, Fauna, Brit. India, Hymen., Vol. I, 1897.
Scolia ASHMEAD, Synopsis, Can. Ent., 1903, p. 7, (subgenus).
Ascoli SCHROTTKY, Deutsch, Ent. Zeitschr., 1910, Heft. II, p. 196.

***Triscolia badia* (Saussure).**

Scolia badia SAUSS. Am. Soc. Entom. France (4), III, 1863, p. 17 ♀ ♂.

The location of the type is unknown to the writer.

Saussure and Sichel have recorded the female of this species as 31 mm. in length and the male as 18 mm. in length. The specimens that the writer has personally examined vary, the females ranging from 22 to 26 inches in length. Only one male was examined. It measured 19 mm. in length.

The body of the species is reddish brown except for a few parts which are black or have black markings. The wings are uniformly fuliginous with metallic reflections, green at some angles, blue at others and purplish at others. The nervures are dull black. This species is one of the largest found in the group.

The specimens which the writer has examined agree well with Saussure's description of the species and also with a good illustration published in Saussure and Sichel's Catalogue, plate IX, except for a few details. In the female the antenna, except more or less of the scape, is black as is also the end and more or less of the margin of the mandible. The small inner plate at the base of the fore wings behind the tegula is also black. In addition a number of the thoracic sclerites frequently show a slight tendency toward blackish at their margins and this also is the case with the lateral and hinder margins of the last ventral abdominal plate. The tips of the claws are also nearly black. The coarse hairs clothing the body are orange yellow, lighter than the color of the plate from which they arise.

In the male the antennæ are entirely black except the underside of the scape which is dull ferruginous. The head from the insertion of the antennæ upward is black except for the emargination of the eyes and a narrow light band behind the eyes which widens below. The tips and inner and outer margins of the mandibles are dark reddish brown. The mesonotum is black except at its extreme lateral margins. The anterior face of the propleuron is also dark tending toward black and the bases of the femora each have a more or less blackening. The posterior plate at the base of the fore wing behind the tegulæ and the three spines at the base of the abdomen are also black.

Saussure and Sichel record this species as from Lower California. The specimens which the writer has examined are also labelled Lower California.

This is the only species occurring in the territory covered by this paper in which the body is practically all ferruginous.

Triscolia fervida (Burmeister).

Scolia fervida Burm., Abh. Naturf. Ges. Halle, I, p. 4, 1853, p. 20, n. 12 ♀
Am.: Texas, Mexico.

The location of the type is unknown to the writer.

Burmeister has recorded this insect as from 14 to 16 lines long, while Saussure and Sichel have recorded the length as from 35 to 40 mm. The females which the writer has examined vary in size from 20 to 28 mm. in length and the males from 15 to 21 mm.

The body of this species is black except the segments of the abdomen behind the second. These are dark reddish brown with very little variation. The wings are uniformly fuliginous with intense metallic reflections, green at some angles, deep blue at some and purplish at others. The nervures are black. This species is one of the largest in this subfamily.

The typical examples are described by Burmeister as all black except the part of the abdomen beyond the second segment which he describes as red, red brown, or rufous. Saussure and Sichel describe a variation in which the posterior part of the second segment is also rufous.

The specimens that the writer has personally examined agree quite well with Burmeister's typical description and also agree with a good figure published in Vol. II of Cameron's *Biologia*, plate 12, figure 17, except that the posterior part of the second segment was always reddish brown or rufous, more evident on its under surface, and the parts described as black by Burmeister have a slight tendency when observed under the lens toward a rufous tinge. The edge of the clypeus, emargination of the eyes, edges of the mandibles, the legs especially the end segments and the spines are usually quite rufous. The edges of the segments of the abdomen described as rufous have a tendency toward darker, sometimes blackish coloring.

Burmeister records the habitat of this species as Mexico; Saussure and Sichel as Mexico and Texas. The writer has seen specimens from Mexico, Arizona, Texas and New Mexico.

Genus **Scolia** Fabricius.

Scolia FAB., Syst. Ent., 1775, p. 355, n. 11.

Generic character: Two closed cubital cells.

Type: *Scolia quadripunctata* Fab.

BIBLIOGRAPHY.

- Scolia* FAB., Syst. Ent., 1775, p. 355, n. 11.
Scolia LATR., Considerations generales sur l'ordre Naturel des Crustaces, Arachnides et Insects, 1810.
Lacosi GUERIN, Duperry, Voy. Coquille, Zool. II, 1830, p. 246.
Discolia SAUSSURE and SICHEL, Cat. Spec. Gen. *Scolia*, 1864, p. 14 (subgenus).
Lacosi SCHROTTKY, Deutsch. Ent. Zeitschr., 1910, Heft. II, p. 196.

***Scolia bicincta* Fabricius.**

Scolia bicincta FAB., Syst. Ent., 1775, p. 356, n. 6.

Location of the type not known to the writer.

Saussure and Sichel have recorded size for the species as ranging between 20 and 25 mm. in length. In the specimens that the writer has personally examined the females range between 15 and 18 mm. in length and the males between 12 and 16 mm.

The body of this species is black except for yellowish white markings on the abdomen varying somewhat in different specimens. The wings are uniformly fuliginous with metallic reflections, blue at some angles, purplish at others. The nervures are black. This is a medium sized species.

The typical examples of this species are described by Fabricius as being black with two broad ferruginous bands at the base of the second and third segments of the abdomen. There are variations from this however. Burmeister in his work describes the spots as yellowish white instead of ferruginous and describes a specimen which has white markings on the first segment of the abdomen and the band on the third segment broken into spots.

Saussure and Sichel in their catalogue describe several specimens differing from the typical form. One of these has a yellowish white spot on the first abdominal segment, another has the bands interrupted forming spots and another has a yellowish band on the first segment and two yellowish white spots on the ventral part of the second segment.

The specimens that the writer has personally examined agree quite well with Fabricius' description except a few specimens which have the usual bands interrupted, forming spots; a few which have a narrow band of yellowish white across the dorsum of the first abdominal segment, others which have a small yellowish white mark on the postscutellum and some which have two oval spots on the ventral part of the second abdominal segment and two very small yellowish white marks on the dorsum of the fourth segment.

This species is recorded by Saussure and Sichel from boreal America. The writer has seen specimens that were collected from points that show its distribution in the United States from Texas to Massachusetts. Probably it does not occur much farther north than the latter state.

The Insect Book by L. O. Howard (plate I, No. 3), gives a good illustration of this species.

***Scolia consors* Saussure.**

Scolia consors SAUSSURE, Ann. Soc. Ent. France, (4), III, 1863, p. 18, ♂

Scolia amena. CRESSON, Proc. Ent. Soc. Phil., IV, 1865, p. 447, No. 3. ♂

The type of *amena* is at the American Entomological Society rooms at Philadelphia.

Cresson describes the species as follows:

"*Scolia amoena*, n. sp.

"Black; orbits, two spots on prothorax, postscutellum, two large marks on third segment of abdomen, a broad band on the fourth and a narrow line on the fifth, yellow; most of legs, sides of first and second abdominal segments and most of the venter dull rufous; wings subhyaline, the costa fuscous.

"Male.—Black, clothed with short pale pubescence, rather sparsely punctured; orbits, narrow behind, yellowish, indistinct; mandibles rufous at base, antennæ as long as the head and thorax, entirely dull black. Thorax: two small triangular spots on the prothorax in front, and a transverse line on the postscutellum, yellowish; metathorax immaculate, very abrupt behind and concave; tegulæ piceous. Wings subhyaline, the costa broadly fuscous. Legs piceous, with palish pubescence; all the femora more or less rufous. Abdomen robust, black, sparsely punctured, shining, somewhat iridescent; sides of the first and second dorsal segments and the whole of the second ventral, rufous; two large, irregular, almost confluent, yellow marks on the fourth segment above; a broad, yellow band on the fourth segment, scalloped anteriorly, and on the fifth segment a narrow transverse yellow line; apical segment piceous, with three very short, subacute teeth. Length 7 lines; expanse of wings 12 lines.

"One specimen. A very handsomely ornamented species."

The writer has carefully examined the type specimen at Philadelphia and has also examined one other specimen at the same place. This last varies from the above description somewhat. The orbits of the eyes are not all yellow but there is a broad yellow mark starting within the lower part of the emargination of the eyes and extending downward along the border of the lower lobe; there is also a narrow streak of the same color behind the eye. The yellow on the postscutellum is a band instead of a line. The tegulæ are ferruginous. The coxæ are black and ferruginous in varying proportions.

The trochanters, bases of the femora and the tarsi are blackish ferruginous. The rest of the legs are light ferruginous with the broad faces of the femora lightest. The dorsum of the first segment of the abdomen has a ferruginous band and its under side is ferruginous behind. The front face of the venter of the second segment is black and the venters of the segments from the fourth backward with the dorsum of the last two segments are obscure ferruginous. The wings

are fusco-hyaline with a darker area along the costal margin including the costal end of the median, stigmal, first cubital, and radial cells and continuing beyond the cellular area nearly to the tips of the wings. The part of this darkened area within the cells is faintly yellowish, that beyond is smoky. The wings have slight purplish metallic reflections when held at certain angles. The nervures are dark ferruginous. The specimen is quite coarsely covered with whitish hairs except the dorsum of the last three segments of the abdomen where they are yellowish.

The above specimen, a male, was taken in Lower California and is now in the collection of the American Entomological Society at Philadelphia.

The type specimen was taken in Colorado.

These two specimens agree very well with Saussure's description of *consors* and the writer thinks that they will probably prove to be the same species. Because so little material could be examined, further collecting and study should prove or disprove the above conclusion. If the writer is justified in the above statement then the name *amoena* should fall and *consors* take its place. The specimens in the Philadelphia collection have been placed under the name *consors*. The writer does not know who is responsible for this.

***Scolia cubensis*.** New species.

Type, a female from Cuba now in the collection of the American Entomological Society at Philadelphia, and the only specimen I have seen.

The specimen measures twenty-three mm. in length.

The body color is dark brown, almost nigro-ferruginous. The wings are uniformly brownish-fuliginous with metallic reflections blue at some angles, purplish at others. The nervures are brown. The specimen as a whole has a glistening appearance and is remarkably free from punctures or hairs. Most of the hairs present are deep red brown, and the punctures are shallow.

The head is more triangular than those of the other species of this subfamily and the eyes are comparatively much smaller. In other species they extend from very close to the base of the mandibles to quite near the top of the head: here they start well up from the base of the mandibles and reach only about 2-3 of the distance to the top of the head. Viewed from the side they take up only about one-third of the usual space.

The anterior lateral margins of the clypeus are set with short bristle-like yellow hair arising from an area which is obscurely yellow. The outside of the antenna beyond the third segment is quite ferruginous and the prothorax in front is rather thickly punctured and covered with long brownish hairs. The rest of the body except the venter of prothorax, pronotum, ridge of the mesopleuron, legs, and front face of the dorsum of the first segment of the abdomen is remarkably free from punctures and hairs, the top of the head, centre of the mesonotum and the central portion of the scutellum and postscutellum being particularly free. The abdomen as a whole has a slender appearance being narrow and long. At the point where the second segment of the abdomen beneath bends abruptly upward to meet the first segment and on either side of the mid line of the body there is a slight tubercular tendency. The larger spine at the end of the hind tibia is a great deal less than half the length of the first tarsal joint.

The writer has seen no other specimen like the above and no description that he has been able to find agrees with it. He has therefore described the form as a new species. He believes that when the male is studied it will be found to have distinct rounded tubercles on the ventral surface of the second abdominal segment where the segment bends upward to meet the first. This last is because of the slight tubercular tendency spoken of above in the female studied and in all species observed by the writer having these tubercles the male always has them well developed, the females only slightly or not at all.

Scolia dubia dubia Say.

Scolia dubia. Say, Boston Jour. Nat. Hist., I, p. 4, 1837, p. 364, n. 2.

The type of this species is not in existence.

Say has recorded the length of the species as four-fifths of an inch. Saussure and Sichel record the females as 22 to 25 mm. and the males as 15 to 23 mm. in length. The length of the specimens that the writer has had the opportunity to personally examine vary in the female from 15 to 22 mm. in length and the males from 13 to 19 mm.

Except for slight variations, the body of this species is black to the end of the second segment of the abdomen and the rest of the abdomen is reddish brown. The third segment of the abdomen has on each side of its dorsal surface, an ovate yellow spot. The wings are uniformly fuliginous, with metallic reflections, blue at some angles, delicately purple at others. The nervures are black.

The typical examples of this species are described by Say in the Boston Journal of Natural History, Vol. I, page 363. The body is black; head and thorax immaculate; wings dark violet blue; cubital cells two, with no appearance of more than one recurrent nervure; abdomen, first and second segments black; remaining segments ferruginous, more hairy than the others; the third segment, however, more or less tinged with blackish and with two transversely oval, a little oblique, bright yellow spots.

The specimens that the writer has personally examined agree quite well with the above description except that there is a strong tendency for variation in three directions. In one direction the specimens have the first two segments quite ferruginous. In another the whole abdomen is very black, only the edges of the segments beyond the second being ferruginous. In the other specimen the yellow spots gradually diminish until they entirely disappear. Smith in his Catalogue of Hymenopterous Insects of the British Museum describes a variety in which the yellow spots are obsolete. It is probable that this form without spots is the one that has been described by Burmeister as a separate species *hæmatodes*. The writer thinks that this form should be regarded as a subspecies of *dubia*. This would cause the name *dubia* to become *Scolia dubia dubia*; and *hæmatodes*, *Scolia dubia hæmatodes*.

Saussure and Sichel have recorded this species as found in North America; Carolina, Louisiana, Maryland, Tennessee, and Mexico. The writer has seen specimens from Mexico, Texas, Arizona, Georgia, Carolina, Virginia, Maryland, New York, and Massachusetts. Probably this species does not exist farther north than the last named state.

The Insect Book by L. O. Howard, plate I, fig. 7, gives a cut of this species.

***Scolia dubia hæmatodes* Burmeister.**

Scolia hæmatodes BURM., Abh. naturf. ges. Halle, I., p. 4, 1853, p. 33, n. 49. ♀ ♂

The location of the type is unknown to the writer.

Burmeister describes the species as follows: Black, hairy, abdominal segments 3 to 6 rufous, wings nigro-cyanis. The length 7 to 8—¹¹¹ ♂ + ♀ —Mexico.

This insect looks like and is colored and haired like *Scolia dubia* except that the two yellow spots on the third abdominal segment are wanting. As a whole, it is much smaller than *dubia*.

The writer has seen a large number of specimens that agree with this description except that one male specimen he has before him, has the sclerites of the abdomen black or slightly ferruginous and only the hairs

which clothe those segments from the second back are rufous. The venter of the second abdominal segment is usually rufous except in the darker specimens.

The length of the female ranges between 15 and 22 mm. and the males between 10 and 18 mm.

This species is fully accounted for under the variations in the description of *Scolia dubia dubia*, which see for further information on the subject.

The specimens I have seen were taken in Mexico, Texas, California, and Arizona.

***Scolia flavocostalis* Cresson.**

? *Scolia tricineta* SAY West. Quart. Reporter, II, 1823, p. 74.

Scolia flavocostalis. CRESS., Trans. Amer. Ent. Soc., I, 1868, p. 377, no. 6, ♂

The type is in the collection of the American Entomological Society at Philadelphia.

Cresson describes the species as follows:

"*Scolia (Discolia) flavocostalis*, n. sp.

"Male.—Black, deeply and rather closely punctured, clothed with long, golden pubescence; a spot on the anterior orbits, below the emargination of the eyes, and a narrow line on lower half of posterior orbits, yellow; mandibles bright fulvous, black at tips; antennæ entirely black, robust; a spot on each side of prothorax anteriorly and another on postscutellum, yellow; scutellum with large, scattered punctures; tegulæ fulvous; wings hyaline, with an opaline reflection, costa broadly yellow to the tip of marginal cell, beyond which it is violaceous-black; anterior wing with two submarginal cells, the second receiving one recurrent nervure; legs rufo-ferruginous, clothed with yellowish hair, most of coxæ black; abdomen black, clothed with yellowish hair, especially dense on the apical margins of the segments, apex of the three basal segments more or less ferruginous; on each side of second and third segments above a yellow ovate spot, large and transverse on the third segment; fourth segment with a narrow, apical, yellow band, interrupted in the middle, and dilated laterally; apex with three short spines; venter blackish, most of the second segment ferruginous. Length $4\frac{1}{2}$ lines.

"One male specimen. This may be the male of *S. Lewisii*. It is, however, much smaller."

Besides the type in the American Entomological Society's collection at Philadelphia, the writer has studied several specimens and has several before him, three of which closely agree with the description except that one has two large ferruginous spots on the dorsum of the first abdominal segment, one has a broad ferruginous band on the posterior part of the above segment and the fifth and sixth segments have an apical band of yellow, and the third has a narrow interrupted band of yellow on the fifth abdominal segment. The other specimens that have been studied

vary somewhat in the amount of yellow and ferruginous color present, especially on the abdomen where the spots gradually enlarge to become bands, and the bands on the posterior segments are much broader. The dorsum of the median segment and the first and second segments of the abdomen gradually become ferruginous until they are practically all of that color. The writer thinks that perhaps this variation which is possibly in the direction of either *ridingsii* or *lecontei*, indicates the relationship of the three species, especially as all the specimens of *flavocostalis* seen were males. It is probable that more material will throw light on this subject.

The above specimens are all males all taken in New Mexico, except one from Texas and one from Kansas. They measure between 10 and 15 mm. in length.

Four other specimens have been studied, a female and three males, which starting with the more typical *flavocostalis*, vary toward a blacker body color and a reduction of yellow. One specimen has the body black except for a slight tendency toward ferruginous on the venter of the abdomen. The coxæ, trochanters and a small part of the femur next to the body are black. The tarsi and tarsal claws are dark ferruginous. The dorsum of the fourth segment of the abdomen has two yellow spots and the fifth segment has an obscure, interrupted, apical yellow band. One specimen has no yellow mark behind the eyes and no yellow on the fifth abdominal segment, with the body color practically all black except a slight tendency to ferruginous at the edges of the sclerites. Much more of the femur is black than in the other specimen. The female specimen has the mandibles except the tips, an obscure streak behind the eyes, the dorsum of the prothorax and the dorsum of the first abdominal segment ferruginous. The legs are nearly all ferruginous with a blackish tendency on the basal segments. The dorsum of the second and third abdominal segments have spots and the fourth and fifth have narrow yellow apical bands. The head in the above specimens except for the slight yellow marks spoken of, is all black.

These four specimens were all collected in Texas. The female measures about 11 mm., the males 9 to 11 mm. in length.

Some of the last described specimens came very near to Say's *tricincta* (Western Quarterly Reporter Cincinnati, II, 1823, p. 74, n. 2), and the writer does not agree with Cresson in placing *tricincta* under *nobilitata* but thinks further studies will probably place it somewhere in the above range. If this is correct, then *flavocostalis* will ultimately fall as a synonym of *tricincta* or become a subspecies of it.

***Scolia fulviventris*.** New species.

This species is described from a type and five paratypes, all females; the type and two paratypes are in the collection of the American Entomological Society at Philadelphia, two paratypes in the collection of the Museum of the Brooklyn Institute and one in the collection of the Massachusetts Agricultural College.

The specimens range between eleven and fifteen mm. in length.

The ground color of the species is black with yellow markings. The wings are dark fuliginous with a darker area running along the costal border from near the end of the costal cell to the tip of the wing, and give off metallic reflections, blue at some angles, purplish at others. Most of the dorsum of the abdomen is yellow and its whole venter is ferruginous.

The head is black except a ferruginous, almost yellow spot just below the emargination of the eyes, a yellow streak behind the eyes and the middle of the anterior margin of the clypeus, which is ferruginous. It is quite thickly covered with yellowish white hairs especially thick and long in the area between the bases of the antennæ and the anterior ocellus and on the occiput. The mandibles are ferruginous, more or less streaked with black. The antennæ are black, the three basal segments glistening.

The thorax is black except two large triangular marks on the pronotum running nearly back to the tegulæ and a band covering the entire central portion of the postscutellum which are yellow. The dorsum of the mesothorax is covered with short yellow hairs, the rest of the thorax with short grey hairs. The tegulæ are black ferruginous. The legs to the end of the femur are black ferruginous, the tibia and tarsus becoming lighter. The larger spines are light ferruginous and the smaller ones yellowish. The tarsal claws are ferruginous, blackish at the tips. All of the legs are covered with rather long yellowish white hairs and the large spine at the end of the hind tibia is nearly one-half the length of the first tarsal segment.

The first two segments of the abdomen are black above, with two small yellow spots on the first and two large confluent spots on the second. The third, fourth and fifth segments above are yellow, narrowly margined with ferruginous, the yellow band on the third being slightly constricted in the middle. The sixth segment above and the venter are entirely ferruginous. All the segments are covered with short, and their edges fringed with long yellow hairs, paler beneath.

The paratypes differ from the above type in one or more of the following features. The ferruginous on the clypeus and along the inner margins of the eye varies greatly in amount. The pronotal yellow spots differ much in size. There may be a pair of ferruginous or yellowish spots on the median portion of the scutellum. The first abdominal segment above may be more or less tinged with ferruginous or may be black and without spots in either case. The spots on the second segment may not be confluent and the band on the third may be practically transformed into two spots. The distribution of ferruginous on the legs varies, sometimes extending well upward toward the body.

All the specimens were collected in Arizona.

The writer thinks that perhaps these insects may ultimately prove to be the females of *otomita*: See statement under *otomita*.

***Scolia fuscipennis*.** New species.

Type and paratype in the United States Museum at Washington, D. C.

This species was described from two male specimens taken at Cordoba, V. C., Mexico; the type Jan. 16, and the paratype Feb. 8, 1908, by Fred K. Knab.

Type number 15092, U. S. Nat. Mus.

The ground color of this species is jet black with yellow markings on the thorax and abdomen. The wings are dark fuliginous, distinctly glossy brown, without color reflections and have a darker area along the costal cells. A light streak runs downward and backward from the end of the costal cell across the first cubital. The nervures are dark brown or black.

The head is black, deeply and rather closely punctured and is well covered with brownish hairs. The mandibles are dark ferruginous. The antennæ are black with scape and pedicel glistening, their remainder dull. Behind the eye in the type is a faint yellow spot absent in the paratype.

The thorax is black except two large marks on the pronotum running back to the tegulæ, a large mark on the upper part of the mesopleuron, two narrow longitudinal lines behind the middle of the dorsum of the mesothorax, the entire central portion of the scutellum, the elevated portion of the postscutellum slightly separated from the scutellar spot in front by a black narrow band, large marks on the lateral lobes and a small mark on the central part of the median segment above, are yellow. It is deeply and closely punctured and thickly clothed with dark

or black hairs except those which arise from the yellow spots which are pale, almost white. The legs are black, covered with black hairs and spines except the large spine belonging to the cleaning apparatus at the end of the fore femur which is ferruginous and the small pad at its base which is yellowish. The fore tarsi have a somewhat ferruginous tinge. The longer spine at the end of the hind tibia is about one-half the length of the first tarsal segment.

The abdomen is black except a broad yellow band on the dorsum of the first segment, which in the paratype is evidently a pair of confluent spots. There are also two large spots on the dorsum of the second and third, two small spots toward the sides of the fourth and two large spots on the venter of the second segment which are yellow. The abdomen is quite closely punctured and is well covered with black hairs except on the spots where they are pale. At the point where the second ventral segment bends abruptly upward to meet the first and on either side of the midline of the body are two bluntly rounded tubercles.

The paratype has no yellow marks on the mesopleuron, dorsum of the mesothorax, scutellum and middle part of the median segment and the pronotal spots are much smaller.

The length varies from 18 to 20 mm. and the body is rather slender.

Scolia guttata guttata Burm.

Scolia guttata. BURM., Naturf. Ges. Halle, I, p. 4, 1853, p. 36, n. 57, ♀

Scolia (Discolia) hecate. W. F. Kirby, Trans. Ent. Soc. London, 1889, p. 449,
♀ ♂ T 15 F 4.

The location of the type is unknown to the writer.

Saussure and Sichel have recorded size for this species as follows: females 22 to 35 mm. long and males 15 to 28 mm. long. Specimens that the writer has personally examined vary in length. The females range from 21 to 28 mm. in length and the males from 15 to 23 mm. in length.

The body of this species is black except for yellow markings, varying in number and size on different individuals. The wings are uniformly fuliginous with metallic reflections, blue at some angles, purplish at others. The nervures are black in some specimens and ferruginous in others. This species is one of the largest of this subfamily.

The typical examples of this species are described by Burmeister as having a round golden spot on each side of the second and third segments with small round golden spots on the underside of the fourth segment. There is considerable variation from this however, as is stated by Cameron in the *Biologia*. He says that this is a very variable

species not only in size but in coloration. He describes several specimens showing a gradation in variation from yellow markings on the clypeus, pronotum, mesopleura, scutellum, postscutellum, first, second, third, fourth and last abdominal segments to two specimens which had no yellow at all. He says the most common form is the one with the maximum yellow upon it and that the male examples do not show much variation. They have either two yellow marks on the first and second abdominal segments or two on the second segment only.

The specimens that the writer has personally examined agree quite well with Burneister's typical description except that the yellow markings on the fourth abdominal segment would hardly be regarded as being on the under side of the segment though well down on the side. At the point where the second segment of the abdomen bends abruptly upward to meet the first ventral segment and on either side of the midline of the body are two bluntly rounded tubercles quite large in some specimens especially in the males, smaller and almost disappearing in the females.

Between this species and *azteca* the writer has been able to find no structural difference and it is his opinion that the two forms can be separated only by the color, *azteca* being entirely black and *guttata* as described above. This color distinction has been easily drawn in all the specimens observed and so the writer has chosen to consider the above as two forms, with *azteca* a subspecies of *guttata*. This causes the name *Scolia guttata* to be changed to *Scolia guttata guttata* and *Scolia azteca* to *Scolia guttata azteca*.

Saussure and Sichel have recorded this species from Mexico.

The specimens that the writer has seen came from the plains of Mexico and from the southern part of Texas.

Scolia guttata azteca Sauss.

Scolia azteca SAUSS., Rev. et Mag. Zool, (2), (IX), 1857, p. 281.

Location of the type unknown to the writer.

Saussure records the length of the species as 27 mm. The length of the specimens that the writer has had the opportunity to examine varies in the female from 18 mm. to 29 mm. The males measure about 20 mm.

The color of this species is deep black. The wings are uniformly fuliginous throughout with metallic reflections, blue at some angles, purplish at others and greenish at still others. It is one of the larger species of the group.

The typical examples are described by Saussure as follows: The female on the average of a deep black, shining, with black hair. Head and thorax very finely punctured; the metathorax deeper than the rest, abdomen irregularly punctured, wings deep black with bluish or steely reflections. The nervures are black. Males are very densely punctured.

The specimens that the writer has studied agree with this description except that the wings held at some angles have a greenish reflection as well as the bluish and purplish reflections spoken of above. At the point where the second ventral segment of the abdomen bends abruptly upward to meet the first ventral segment and on either side of the midline on the body is a bluntly rounded tubercle quite large in some specimens especially in the male, smaller and almost disappearing in some of the females.

Saussure and Sichel in their catalogue give the habitat of the species as Mexico. All specimens that the writer has seen came from Mexico.

So far as structure goes the writer has been unable to separate this species from *guttata* Burmeister. He is of the opinion that aside from the color they cannot be separated and for this reason he would consider this form a subspecies of *guttata*. See what already has been said on this subject under *guttata*.

***Scolia inconstans* Cresson.**

Scolia inconstans CRESS., Proc. Ent. Soc. Phila., IV, 1865, p. 446, No. 2.

The type is in the collection of the American Entomological Society at Philadelphia.

Cresson describes the species as follows:

Scolia inconstans, n. sp.

"Obscure ferruginous; head, antennæ and most of thorax blackish; sides of prothorax with a large luteous spot; third segment of abdomen with a yellow spot; wings subhyaline, the costa yellowish, with a dark streak beyond the marginal cell.

"Male.—Head black, with yellowish pubescence; the orbits, more or less interrupted, yellowish; anterior margin of the clypeus, and the mandibles, except tips, luteous; antennæ nearly as long as the head and thorax, dull black, somewhat brownish beneath. Thorax blackish, with rather dense, prostrate, yellowish pubescence, and close, rather deep punctures; on each side of the prothorax a large luteous spot; lateral margins of the mesothorax obscure testaceous; pleura sometimes with a ferruginous stain; postscutellum luteous, and sometimes the scutellum is tinged with the same color; metathorax black, sometimes rufo-piceous, on each side a large rufous or ferruginous spot or stain,

the posterior face abruptly truncate and somewhat concave; tegulae ferruginous. Wings hyaline, slightly dusky on the broad apical margins, and with a slight violaceous reflection; the costa yellowish, especially about the marginal and submarginal cells, and beyond the former a blackish streak extending to the tip of the wing; nervures fuscous. Legs ferruginous, with yellowish pubescence. Abdomen obscure ferruginous, punctured, shining, iridescent, clothed with yellowish pubescence, more dense on the apical margins of the segments; basal segment rounded at base and more closely punctured than the following segments, the apical margin slightly contracted; third segment with a large, transverse, yellow macula on each side, and the apex, of the fourth segment is narrowly margined with yellowish; in one specimen the spots on the third segment are very large, while the two basal segments have a small obsolete, luteous stain on each side at base, and the fourth segment has an angular yellow mark on each side; the base of the third, fourth, and fifth segments are sometimes more or less blackish; the apical segment is armed at tip with three long acute spines, the central one the longest; ventral segments ferruginous, with their base more or less blackish. Length 6—6¼ lines; expanse of wings 11—11½ lines.

“Two specimens. This species has some resemblance to *S. dubia* Say, in the markings of the third abdominal segment, but is otherwise very distinct.”

There are two specimens in the collection at Philadelphia both marked types. The writer has examined both and has one before him marked type number 568-2 which varies a little from the above description. The yellow mark in front of the eyes starts well within the emargination, is quite broad and extends downward along the lower lobe of the eye. There is a narrow yellow streak behind the eyes. The antennae are slightly ferruginous beneath. The body color of the thorax is black but all the sclerites have a marked tendency to be tinged with ferruginous. The pronotum has two large triangular spots which are joined together in front by a narrow darker band and extend back to the tegulae. The postscutellum has a broad yellow band and the tegulae are light ferruginous almost flavous. The median or last segment of the thorax, has a ferruginous spot on the dorsal surface of each side lobe and on its central part a slight tinge of the same color. The wings are subhyaline with a stained area along the costal border. The costal, end of the media, stigmal, first cubital and radial cells with a small portion just beyond the radial are light yellow and covered with short yellow hair. The area from just beyond the radial to near the end of the wings is slightly smoky and gives a light purplish metallic reflection at some angles. The nervures are light ferruginous or flavous. The base of each segment of the abdomen has a black band and there

are two large transverse oval spots on the third with a narrow line at the end of the fourth segment which are yellow. All the rest of the abdomen is ferruginous. The length of this specimen is about 12 mm.

The two specimens that the above description was written from were collected in Colorado. The writer has seen no other specimens like these in the Philadelphia collection, although he has seen several collections from that or adjacent territory. It is the writer's opinion that further collections from Colorado would throw much needed light on the identity of this species.

***Scolia lecontei* Cresson.**

Scolia lecontei CRESS., Trans. Am. Ent. Soc., I, 1868, p. 376, n. 5 ♀.

Type in the collection of the American Entomological Society at Philadelphia.

Cresson describes this species as follows:

Scolia (Discolia) Lecontei, n. sp.

"Female.—Head black, sparsely punctured, a large rufous spot on the front, extending from the lower ocellus to and including the space between the antennæ, and also the emargination of the eyes; posterior orbits, clypeus and mandibles, except tips, rufous; occiput clothed with a dense golden pubescence; antennæ short, robust, black, scape dull rufous; thorax with deep, rather close punctures; prothorax, except its anterior middle, extreme lateral margin of mesothorax, tegulæ and scutellum rufous, the latter flat, with a few scattering, deep punctures; postscutellum bright yellow; rest of thorax black, sparsely clothed with golden pubescence, more dense on prothorax in front, and on meta-thorax, the prominent, lateral lobes of the latter with an obscure rufous spot; wings fusco-hyaline, strongly tinged with yellowish, especially along the costa to the tip of the marginal cell, beyond which it is violaceous-black; both wings have a beautiful purple reflection, especially towards the apical margin; anterior wing with two submarginal cells, the second receiving one recurrent nervure; legs rufo-ferruginous, clothed with yellowish hair, most of coxæ black; abdomen rufo-ferruginous, sparsely punctured, shining, second to fifth segments above stained more or less with blackish, second and third segments above with a large, ovate, bright yellow spot on each side, nearly meeting on the disk, those on the third segment more transverse and regular; fourth segment with a transverse yellow band at tip; fifth segment with a subobsolete, narrow yellowish stripe near the tip, sub-interrupted in the middle; apical margins of all the segments with a dense, rather long fringe of yellowish hairs; venter dull ferruginous, the third segment black at base. Length 6 lines.

"One female specimen. At first sight this species has much the appearance of *Elis Xantiana* Sauss."

The writer has one specimen before him which agrees very closely with the above description except for an obsolete yellow spot behind the eyes. Study has been made of other specimens that vary somewhat from the above. Two of these have no yellow marks on the fourth and fifth segments of the abdomen and the whole insect has a dark rufous to blackish appearance, showing a tendency to vary toward a loss of yellow and ferruginous on the abdomen especially and has a general darker appearance as a whole. Probably these forms stand somewhere between the typical *lecontei* and Say's *tricincta*.

The writer has seen several other specimens which show a gradual increase in the yellow and ferruginous from the type to a specimen which has the yellow mark behind the eyes and the spots on the prothorax much larger while the spots on the second segment are very large, those on the third have become a broad band and there are two wide bands on the fourth and fifth. Possibly this variation of increasing yellow and ferruginous is in the direction of *ridingsii*.

The specimens that the writer has seen are all females measuring from 12 to 15 mm. in length and were all collected in Texas except one which was taken in New Mexico.

No one specimen has all the marks spoken of at their extreme development as indicated. The head of this species has the occiput quite black and this color encroaches downward upon the upper part of the frons. The rest of the face is ferruginous.

It is probable that further collection will throw much needed light on the relation of *ridingsii*, *lecontei*, *tricincta*, and *flavocostalis*, which seem in many respects to be closely allied.

***Scolia monticola* Cameron.**

Scolia monticola CAMERON, Biol. Centr. Amer., P. 112, 1873, Hymen. II. p. 223, n. 3, ♀ ♂.

The type is probably in the British Museum.

Cameron describes the species as follows: "Deep black, shining; the head and thorax densely covered with short, thick, black pubescence; the back of the abdomen densely covered with short, the ventral surface with long, black hairs. The head covered with large, distinctly separate punctures; the mesonotum and scutellum coarsely and strongly punctured, somewhat smaller than those on the mesonotum. Abdomen closely and finely punctured; the hair on the apical segments above long, black and thick. Legs deep black, the spines and hair also black. Wings deep violaceous-blue. The male is similarly colored and clothed, the antennæ in this sex bearing a close microscopic greyish pile, which gives them a paleish appearance. Size of the female 18 to 20 mm., of male 15 to 18 mm."

At the end of the above description Cameron says: "It is obvious that the insect is nearly related to *Scolia azteca*; the latter, however, differs from *Scolia monticola* in having" (from this point to the end of the paragraph is a translation) an obtuse median tubercle at the base of the second ventral segment which is subtruncate. In the female this tubercle is minute almost disappearing. In the male it is larger, somewhat broader transversely emarginate in the middle and subcarinate on either side.

The writer has but two specimens which he could consider as this species. They measure about 13 mm. in length and agree well with the above description. The point of difference in the presence or absence of the tubercle on the venter of the second abdominal segment is borne out. These specimens do not have it. The whole specimen is black and the body except the front of the head is thickly punctured and haired. A part of the frons starting just below the bases of the antennæ and continuing upward between them, then gradually widening to a straight transverse line which if continued would intercept the eyes at the upper edges of their emarginations, is raised above the rest of the face enough to allow for the insertion of the antennæ in its sides instead of in the usual depressed space. The part of this raised portion posterior to the bases of the antennæ is closely and deeply punctured. The rest of the face is sparsely indented with rather deep punctures. Starting at a point just posterior to the larger ocellus a continuous ridge passes downward and outward across the frons to a point within the emargination of the eyes. The wings are fuliginous with a darker area along the costal border, and they have conspicuous metallic reflections, blue at some angles, green at some and bright purple at others with perhaps a slight tendency toward magenta in places.

This species is easily distinguished from others in this subfamily by the peculiar elevation of the portion of the frons spoken of above. This is not referred to by Cameron and therefore possibly the insect here described is not *monticola*. If it should prove not to be *monticola* it may be given the name *nigrescens*.

The two specimens are now in the American Museum at New York City. Locality unknown. They agree quite closely with a specimen in the American Entomological Society collection at Philadelphia marked *nigrescens* type, undoubtedly a manuscript name. More material should throw needed light on this species.

***Scolia nobilitata* Fabricius.**

Scolia nobilitata FABRICIUS, *Systema Piezatorum*, 1804, p. 244, n. 32.

Smith in his catalogue of the British Hymenoptera, page 206, records a Fabrician specimen in the Museum of the Linnaean Society of London.

Burmeister has recorded size for this species as 5 to 8 lines. The length of the specimens that the writer has had the opportunity to examine vary in the female from 12 to 16 mm., in the males from 8 to 12 mm.

In comparison with the group as a whole this is a small species. The body is black and there are always four yellow spots on the abdomen, the second and third segments each having two. In a large number of cases there is a ferruginous tinge to the abdomen and the yellow markings on the body are encroached upon by this coloring. The wings are uniformly fuliginous with violet reflections at some angles, blue at others. The nervures vary from dark ferruginous to quite black.

Fabricius described the type as hairy and black, with two yellow spots on the prothorax and the scutellum yellow, base of the abdomen ferruginous and bearing four yellow spots.

Head black, antennæ cylindrical, thorax globose, black, prothorax has two yellow spots, postscutellum yellow. Abdomen hairy and black, the three basal segments obscurely brick red. Segments two and three each with two yellow spots. Legs ferruginous, femora black.

The Insect Book by L. O. Howard (plate I, fig. 2) gives a good cut of a female of this species.

The specimens that the writer has examined agree quite well with Fabricius' description and also with the illustration given by Howard, except for slight variations. The average female has a black head except for the mandibles and the underside of the antennæ. The mandibles are ferruginous, becoming almost black toward their tips and the antennæ though mainly black have a ferruginous tinge, particularly beneath.

The thorax is black except for two yellow triangular spots on the pronotum, a large yellow mark on the postscutellum and the tegulæ which are ferruginous. Coxæ and trochanters black, femora partly black, partly ferruginous and the remaining portions of the legs ferruginous except the tips of the claws which are black, spines ferruginous. Wings uniformly fuliginous, with blue and violet reflections. The ground color of the abdomen is black but there is a tinge of ferruginous especially in the first three segments, more generally present in the first.

The second and third segments have on each side of their dorsal surface a large oval yellow spot.

The writer has seen several specimens which varied from the above in that although the ground color of the body was black, a great part of the head, edges of the sclerites of the thorax, scutellum, dorsal part of the median segment, nearly all of the legs and the dorsum of the first segment of the abdomen were ferruginous while the rest of the abdomen was deeply tinged with the same color. A few specimens had two small yellow spots on the first segment of the abdomen and a yellow streak behind the eyes. The above description with the same variations will apply to the male. The writer has also seen a male with two small yellow marks on the fourth segment of the abdomen. The antennæ of the male are entirely black. The variety *maculata* Guerin, of this species the writer has been unable to recognize in the material available.

Fabricius records this insect from Carolina, Burmeister from North America. The writer has seen specimens from Florida, Georgia, North Carolina, Pennsylvania, Virginia, Texas, Long Island, N. Y., and Arizona.

Scolia otomita Saussure.

Scolia otomita SAUSS. Am. Soc. Ent. France, (3), VI, 1858, p. 223, No. 35 ♂.

The location of the type is unknown to the writer.

Saussure and Sichel describe the species in their catalogue. The following is a translation of the description:

Male.—Small, black, greyish haired, abdominal segments three to five with yellow fascia. Length $12\frac{1}{2}$ mm.; wings, 10 mm.

Small, black, densely punctured, covered with grey hair. A small yellowish silvery spot on each side of the face outside of the clypeus. Two yellow spots on the prothorax and postscutellum yellow. The tegulæ are brown, segments three, four, and five of the abdomen bear a yellow band which is margined only at the fifth. The smaller margins of the segments brown. All the segments of the abdomen strongly ciliated with tawny yellow hair. The end of the abdomen brown. Legs black, clothed with grey hairs. Tibial spines ferruginous. Wings transparent, nervures brown, radial cell subtriangular, large and truncate. Habitat Mexico.

The writer has seen but one specimen, a male, which he could consider as this species. This specimen measures 13 mm. in length. Its ground color is black. The wings are fusco-hyaline, a much darker portion extending from within the end of the median cell along the costal border almost to the tip of the wing; metallic reflections are present, blue at some angles, purplish at others. The nervures are

black. The head is black except a narrow streak extending downward from the emargination of the eyes along the edge of their lower lobes and a narrow line behind the eyes which are yellow. The mandibles except their edges and tips are ferruginous. The antennæ are black, tinged with ferruginous beneath. The thorax is black except two triangular yellow marks on the pronotum and a transverse yellow band on the postscutellum. The legs are black with a very faint ferruginous tinge and their spines are ferruginous. The first and second segments of the abdomen are black or ferruginous black and the venter of second is slightly tinged with ferruginous. The dorsum of each of the other segments of the abdomen is yellow, their margins ferruginous-brown except the last which is nearly all of this color. The undersides of the last named segments are ferruginous-brown, faintly mottled with yellow. The edges of the segments behind the first are fringed with greyish yellow hairs, with the remainder of the body and legs sparsely clothed with grey hairs except on the clypeus where they are yellowish ferruginous.

The above description was made from a specimen now in the collection of the American Entomological Society at Philadelphia. It was taken in Nevada.

It may be unsafe to draw any conclusions from the study of a single specimen. The writer is of the opinion however that the specimen here described though differing in a few minor details, is *Scolia otimita* Saussure, and that the females described as *Scolia fulviventris* will ultimately prove to be the females of this species.

***Scolia ridingsii* Cresson.**

Scolia ridingsii. CRESS., Proc. Ent. Soc. Phila., IV, 1865, p. 445, No. 1 ♀.

The type is in the collection of the American Entomological Society at Philadelphia.

Cresson describes the species as follows:

“*Scolia ridingsii*, n. sp.

“Ferruginous; sides of prothorax, scutellums, and a large spot on each side of four basal segments of abdomen above, luteous; wings deep yellow, the apical margins broadly fuliginous with a beautiful violaceous reflection, and a dark cloud beyond the marginal cell.

“Female.—Ferruginous, clothed with fulvous or golden-yellow pubescence, closely and rather deeply punctured; the sinus of the eyes and the outer orbits, sometimes luteous, and in one specimen extending entirely across the occiput; mandibles piceous at tips; antennæ piceous, the two or three basal joints ferruginous. Thorax: sides of the prothorax, a spot on the pleura, scutellum and postscutellum, and a spot on each side of the metathorax, sometimes much reduced, luteous; the

scutellums with large, deep, scattered punctures; metathorax short, broad, more finely punctured than the rest of the thorax, abruptly truncate and somewhat concave behind. Wings: the superior pair deep yellowish-hyaline, the apical margin broadly fuliginous with a beautiful violaceous reflection; beyond the marginal cell a broad blackish cloud extending to the tip of the wing; nervures honey-yellow; posterior wings fuliginous, with a purplish reflection, the base subhyaline. Legs ferruginous, with golden-yellow pubescence, the tibiae tuberculate above, the tarsi spinose. Abdomen sparsely punctured, faintly iridescent; on each side of the four basal segments above, a rounded luteous spot; sometimes slightly confluent; the spots on the first and fourth segments smallest, and when confluent, they form a rather broad transverse band; those on the second and third segments are large, the former round and the latter rather transverse; all the segments densely fringed with fulvous pubescence; the apical segment densely clothed with dense, prostrate, fulvous pubescence; venter paler ferruginous, the second and third segments obsoletely stained with obscure luteous, the basal segments deeply contracted. Length 8 lines; expanse of wings $13\frac{1}{2}$ lines.

Two specimens."

The writer has before him three specimens, one marked type 565-2 and has carefully studied four other specimens at Philadelphia, all females. These agree well with the description except the marking described as luteous which the writer would prefer to term yellow. The costal, subcostal and basal nervures of the front wings are ferruginous. The rest of the nervures except the subdiscoidal nervure which is bluish, are yellow. The parts of the fore wing not inclosed within the cells are slightly fuliginous with a much darker area reaching from near the ends of the radial and from within the submarginal, to near the tip of the wing. A streak running along the frenal fold is quite fuliginous. These last areas have metallic reflections, blue at some angles, purplish at others. The hind wings are somewhat fuliginous with slight purple metallic reflections. The end of the fifth abdominal segment has a narrow yellow band and the venter of the first segment is obsoletely stained with yellow.

The other two specimens that the writer has before him differ from the above in that the antennæ beyond the three or four basal segments are quite black above but faintly ferruginous beneath. The yellow band behind the eyes and reaching across the occiput is interrupted in the middle with ferruginous. A band along the parapsidal grooves is black and the anterior edge of the mesopluron is darker than the plate as a whole. The tips of the tarsal claws are ferruginous to black. The yellow marks on the last or median segment of the thorax are obscure in one specimen and wanting in the other.

The head in the above described forms is yellowish ferruginous.

The type specimen and four others were taken in Colorado. The other two whose differences from the type have just been described were taken in California and Lower California. They are all in the collection of the American Entomological Society at Philadelphia. These specimens measure about 15 mm.

The writer also has two specimens before him, one from the United State National Museum, collected in New Mexico and the other from Philadelphia collected in Texas, which vary from the above specimens toward *lecontei*, but standing closer to *ridingsii* than to the other. They vary from *ridingsii* in having the part of the head behind the emargination of the eyes and a large part of the thorax quite black. The specimen at Philadelphia has two yellow spots on the pronotum nearly obsolete and the three spots on the dorsum of the median segment are ferruginous. The dorsum of the second segment of the abdomen has very small round black spots on its sides and the anterior edges of the third and fourth segments are very dark, almost black. The abdomen of the specimen from the United States National Museum has only the small black spots on the sides of the second segment of the abdomen above.

The writer thinks that perhaps further collecting in the above territory may result in uniting *ridingsii* and *lecontei*.

Scolia vintschgaui Dalle Torre.

Scolia saussurei CAMERON, Biol. Cent. Amer., p. 112, 1893, Hymen. II, p. 226, n. 10 ♀; Pl. 12, f. 9.

Scolia vintschgaui Dalla Torre, Cat. Hym., VIII, 1897, p. 187, (new name).

The type is probably in the British Museum.

A good figure of this species is given in Cameron's *Biologia Centrali-Americana*, plate 12, fig. 9. The name *saussurei* used by Cameron, according to the rules of the International Zoological Congress will have to give way to *vintschgaui* because *saussurei* had been already used in 1864 by Saussure and Sichel for an African species of *Scolia*.

Cameron describes the species as follows:

"Black, hairy, two spots on the pronotum and the postscutellum yellow, abdomen bifasciate with yellow, prothorax reddish haired, wings smoky. Length of female, 14 mm.

"Head coarsely punctured; the front ocellus in a deep round pit. Mesonotum coarsely and strongly punctured all over; scutellum punctures larger and more widely separated. Median segment, mid portion finely, lateral portions strongly, punctured. Head and thorax covered

with fulvous hair, that on the median segment being longer and paler. Yellow marks on the pronotum somewhat triangular. Abdomen above covered with long fulvous hair, the fifth and six densely covered all over with fulvous golden hair; basal segments finely punctured, the segments fringed with pale golden hair, third segment for the greater part yellow, the back basal band projecting in the middle; fourth segment is yellow, except for a very black apical band. The legs are black, covered with long, pale hair; tarsal spines rufous. Wings are fusco-hyaline, the fore margin much darker, the dark band extending from the base to near the apex; the costa dark testaceous."

The writer has seen but one specimen, a female, which he could regard as this species. This specimen measures 14 mm. in length. Its ground color is black. The fore wings are fusco-hyaline with a darker streak extending from near the base of the first discoidal cell outward a short distance behind the costa and extending about halfway from the end of the radial to the apex where it gradually disappears. The area between this band and the costa has a distinct yellowish tinge. The wings have metallic reflections, blue at some angles, purple at others. The nervures are black ferruginous. Head, all black except mandibles which are partly ferruginous, antennae entirely black, thorax all deep black except two triangular spots on the pronotum and a transverse band on the postscutellum which are yellow. Legs black, the tarsi particularly the front pair with a tendency toward ferruginous, spines light ferruginous. Abdomen black except two very small spots on the second segment, broad bands on the dorsum of the third, fourth and fifth, which are yellow. The dorsum of the last segment is black. The dorsum of the third, fourth, and fifth are narrowly margined with black, both in front and behind. The dorsal plate of the mesothorax, posterior dorsal margins of the second, third, fourth and the dorsal and ventral posterior margins of the fifth segments of the abdomen are fringed with yellow hair. The dorsal surfaces of the segments from the second segment back are covered with yellow hair. The rest of the specimen is sparsely covered with whitish hair.

The specimen was collected at Guadalajara Jal. Mexico. It is a female and is now in the collection of the American Entomological Society at Philadelphia.

This is the only specimen seen by the writer, which appears to agree with *Scolia vintschgauri* and this one differs slightly in distribution of color. More are needed in order to determine the amount of color variation in this species.

UNIDENTIFIED SPECIES.

I am unable to recognize the following species, which have been described as having been taken within the geographical limits covered in this paper, though I have in some cases ventured to guess at what they may be. The name given is that under which the description was published.

SCOLIA ANCEPS Saussure.

Scolia anceps SAUSS., Ann. Soc. Ent. France, (3), VI, 1858, p. 221, n. 32, ♂.

I think from Saussure's description that this species is the one that Burmeister has described as *haematodes*.

SCOLIA BIDENS.

Sphex bidens L., Syst. Nat., Ed. XII, I, 1767, p. 943. ♀ ♂ Eur. mer.; Afr. bor.; (Am. bor.).

This is a well known Old World species and as there is no recent record of its capture in America it is probably an erroneous record and may safely be omitted from the American faunal list. Saussure and Sichel in their Cat. Spec. Gen. *Scolia* say it is recorded from North America (by error?).

SCOLIA BIFASCIATA Swederus.

Sphex (Scolia) bifasciata SWEDERUS, Svensk. Vet. Akad. Handl. VII, 1787, p. 281, n. 35. New York.
Scolia bifasciata GMELIN, Linne, Syst. Nat., Ed. 13, I, 5. 179a, p. 2738, n. 26.

I have not seen the original description by Swederus but only that of Gmelin which I assume is a copy. From this I am unable to determine anything in regard to this species.

SCOLIA MEXICANA Saussure.

Scolia mexicana SAUSS., Ann. Soc. Ent. France, (3), VI, 1858, p. 213, n. 23, ♀.
Mex.

From Saussure's description I am unable to recognize this insect, but it is probably only a variation of *Scolia guttata guttata*.

SCOLIA NOBILITATA variety MACULATA Guerin.

Scolia maculata GUERIN, Duperry, Voy. Coquille, Zool. II, p. 2, 1830, p. 255 ♀.
Scolia nobilitata var *maculata* SAUSS. and SICHEL, Cat. Spec. Gen. *Scolia*, 1864, p. 132.

I have not seen Guerin's description but Saussure and Sichel in their catalogue give what I suppose is a copy of it. From this the writer has been unable to draw any conclusions in regard to *maculata*.

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INDEX TO LETTERING OF PLATES.

a	anal cell.	md	mandible.
a ₁	anal nervure.	mn	mesonotum.
ab	abdomen.	mp	metapleuron.
ap	apical cell.	ms	median segment.
b	bulb.	mt	metatergum.
bn	basal nervure.	n	neck.
c	costal nervure.	o	ocellus.
c ₁	costal cell.	p	parapsidal groove.
cc	coxal cavities.	pc	anterior coxa.
cl	clypeus.	ped	pedicle.
cu	cubital nervure.	pe	prothoracic episternum.
cu ₁	first cubital or submarginal cell.	pn	pronotum.
cu ₂	second cubital or submarginal cell.	pt	antennal pit.
cu ₃	third cubital or submarginal cell.	re ₁	recurrent nervure.
cu ₄	fourth cubital or submarginal cell.	s	spiracle of median segment.
d	discoidal nervure.	sc	subcostal nervure.
d ₁	first discoidal cell.	scp	scape.
d ₂	second discoidal cell.	set	scutellum.
d ₃	third discoidal cell.	sd	subdiscoidal nervure.
e	eye.	sm	submedian cell.
em	externo-medial nervure.	sp	spine.
ep ₃	mesothoracic episternum.	st	sting.
f ₁	filament.	t	tegulae.
ff	frenal fold.	tc	first transverse cubital nervure.
fh	frenal hooks.	tc ₁	second transverse cubital nervure.
m	radial or marginal cell.	tc ₂	third transverse cubital nervure.
m ₁	radial or marginal nervure.	tm	transverse medial nervure.
mc	median cell.	wc	wing cleft.

EXPLANATION OF PLATES XXII-XXIII.

The figures were drawn with the Camera Lucida.

PLATE XXII.

- Fig. 1. Dorsal view of the last segments of a female *Scolia guttata*.
 Fig. 2. Ventral view of the last segments of a female *Scolia guttata*.
 Fig. 3. Dorsal view of the last segments of a male *Scolia dubia*.
 Fig. 4. Ventral view of the last segments of a male *Scolia dubia*.
 Fig. 5. Antenna of a female *Scolia dubia*.
 Fig. 6. Antenna of a male *Scolia dubia*.
 Fig. 7. Front view of the head of a male *Scolia dubia*.
 Fig. 8. Front view of the head of a female *Scolia dubia*.

PLATE XXIII.

- Fig. 9. Anterior wing of *Triscolia fervida*.
 Fig. 10. Anterior wing of *Scolia dubia*.
 The missing guide line from re₁ in this figure should lead to the nervure joining d and cu.
 Fig. 11. Posterior wing of *Scolia dubia*.
 Fig. 12. Side view of the thorax of *Scolia dubia*.